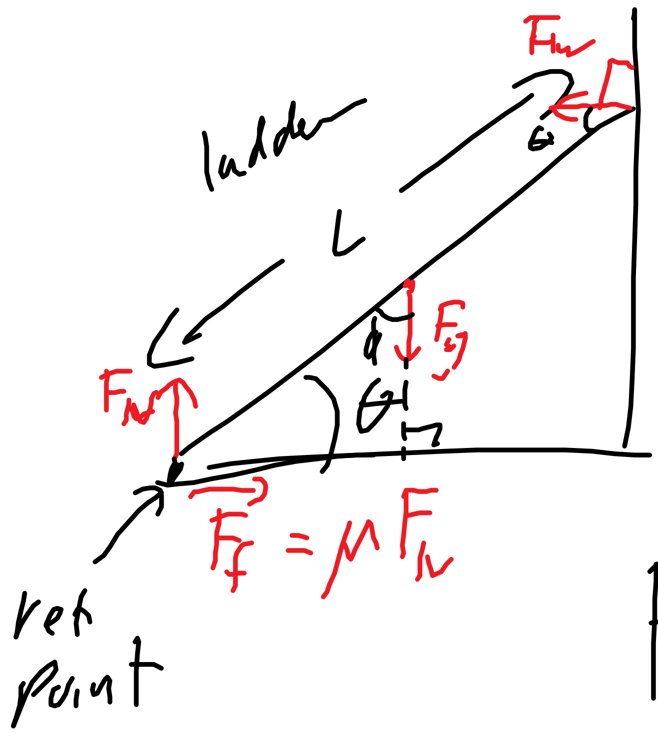
Tuesday, February 14, 2017 8:42 AM

frictionless



$$\tau_c = \tau_{cc}$$

$$F_g \frac{\cancel{L}}{2} \sin\phi = F_w \cancel{L} \sin\theta$$

$$F_w = \frac{F_g \sin\phi}{2 \sin\theta}$$

$$F_N = F_g$$

$$F_f = F_w = \mu F_g$$

$$\mu \cancel{F_g} = \frac{\cancel{F_g} \sin\phi}{2 \sin\theta}$$

$$\phi \downarrow \sin(90-\theta) = \cos\theta$$

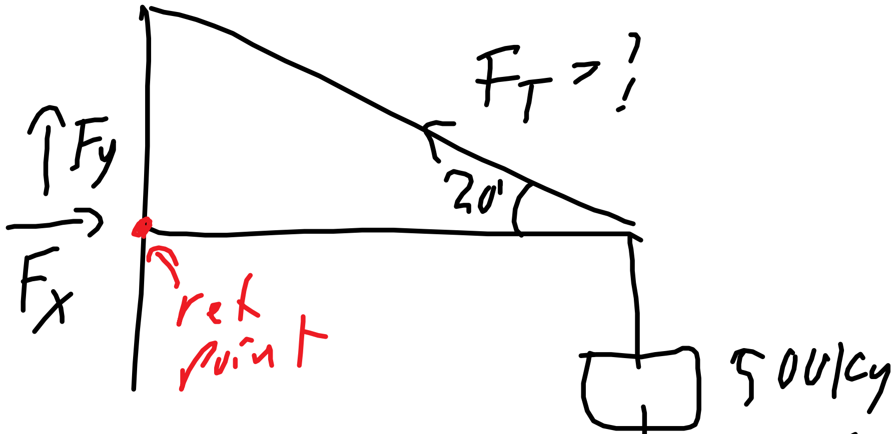
$$\mu = \frac{1}{2 \tan\theta}$$

$$\frac{\sin\theta}{\cos\theta} = \tan\theta$$

$$\theta = \tan^{-1} \frac{1}{2\mu}$$

Practice Quiz

Q1



$F_g = mg = 500 \times 9.8$
$= 4900N$

$\tau_c = \tau_{cc}$

$4900N\,L = F_T L \sin 30°$

$$\boxed{F_T = 9800N}$$

b) $F_y = F_g - F_T \sin\theta = 0$

$F_x = F_T \cos\theta = 9800N \cos 30$

$= 8487N \rightarrow \boxed{8.5 \times 10^3 N}$

Lab
Purpose - determine the relationship between torque and forces in static equilibrium.
Hypothesis - in static equilibrium torques and forces are balanced. torque = Frsinθ
F is force, r is distance to a reference point

and θ is the angle between F and r.
procedure - "refer to lab manual p___"
observations: data table
analysis: show calculations for each data set

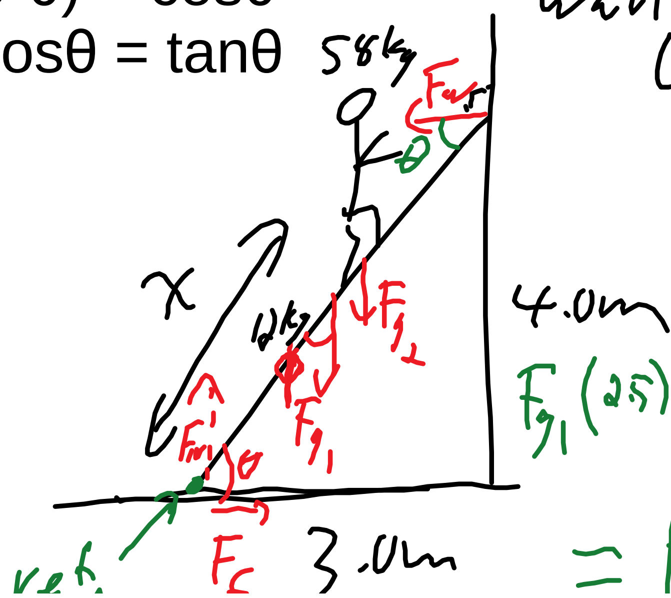
1. sum of torques clockwise=?sum of torques counterclockwise with edge as reference point. % error = deviation/average magnitude
2. sum of torques clockwise=?sum of torques counterclockwise with centre as reference point. % error = deviation/average magnitude
3. sum of forces up=?sum of forces down % error = deviation/average magnitude

conclusion
sources of uncertainty

p238?
Q19 you need to use trig identities
$\sin(90-\theta) = \cos\theta$
$\sin\theta/\cos\theta = \tan\theta$

wall is frictionless
$L = 5.0\,m$

Q21



$\tau_c = \tau_{cc}$

$F_{g_1}(2.5)\sin\phi + F_{g_2}(x)\sin\phi$

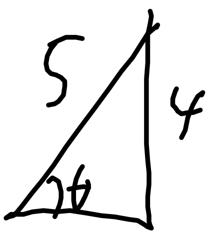
$= F_w(5m)\sin\theta$

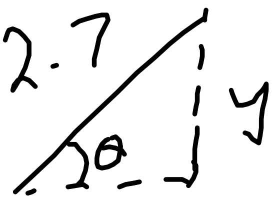
ref point $\vec{F_f}$ 3.0m $= F_w(5m)\sin\theta$

$$12(9.8)(2.5)\frac{3}{\cancel{5}} + 58(9.8)x\frac{3}{\cancel{5}} = F_w(5)\frac{4}{\cancel{5}}$$

12x9.8x2.5x3=882
58x9.8x3=1,705.2
5x4=20
882+1705.2x = 20F_w

look at x components of the forces:
$F_f = F_w = \mu(F_{g1}+F_{g2})$ since the y components of the forces balance
$F_N=F_{gtotal}$
= 0.4x((12x9.8)+58x9.8)=274.4
so subbing in for F_w
x = ((20x274.4)-882)/1705.2=2.7011
$\boxed{x = 2.7m}$ up the ladder before it slips

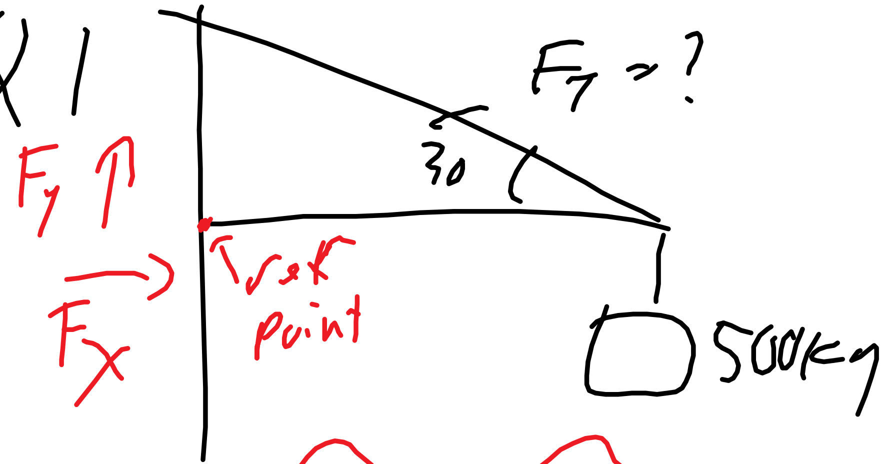




$$\frac{y}{2.7} = \frac{4}{5}$$

$$y = \frac{4}{5} \times 2.7 = \boxed{2.2m}$$

Q1



$$\tau_c = \tau_{cc}$$

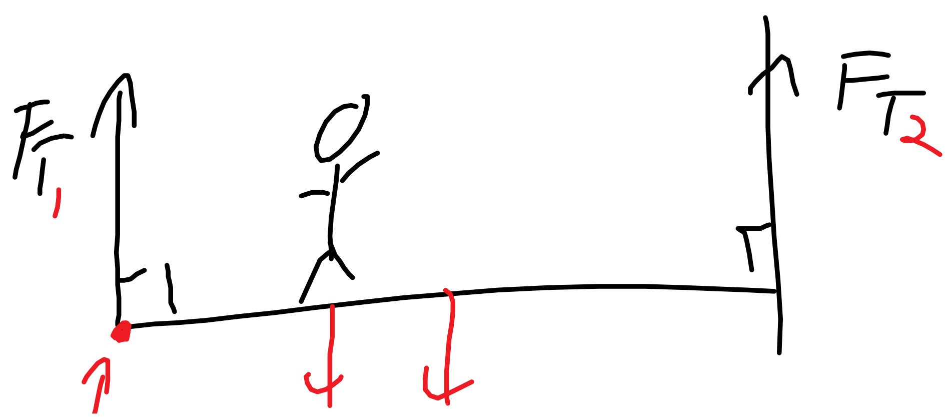
$$(500\,kg)(9.8\,N/kg)\cancel{\Delta}\cancel{\sin 90} = F_T \cancel{\Delta} \sin 30$$

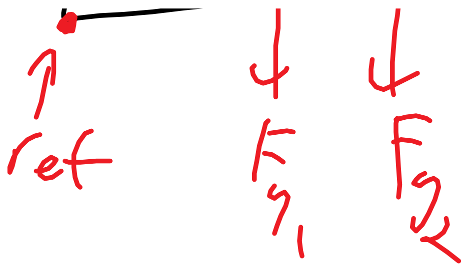
$$\boxed{F_T = 9800\,N}$$

b) $F_y = 500\,kg \times 9.8\,N/kg - 9800 \sin 30°$

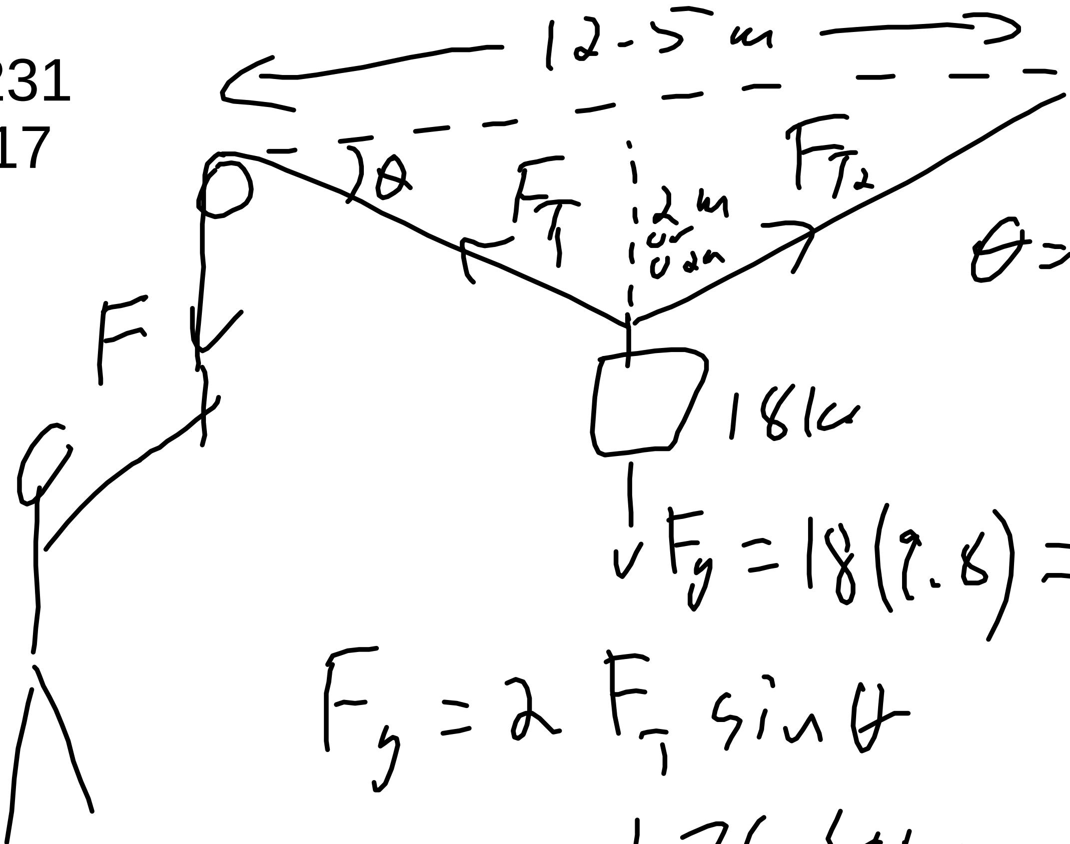
$= 0$

$$F_x = F_T \cos 30° = \boxed{8.5 \times 10^3\,N}$$





p231
Q17



$$\theta = \tan^{-1}\frac{2}{\frac{12.5}{2}}$$

$$F_g = 18(9.8) = 176.4\ \text{N}$$

$$F_g = 2F_T \sin\theta$$

$$F_T = \frac{176.4\,\text{N}}{2\sin(\tan^{-1}(\ldots$$

$$2\sin\left(\tan^{-1}\left(\frac{2 \text{ or } 0.2}{6.25}\right)\right)$$

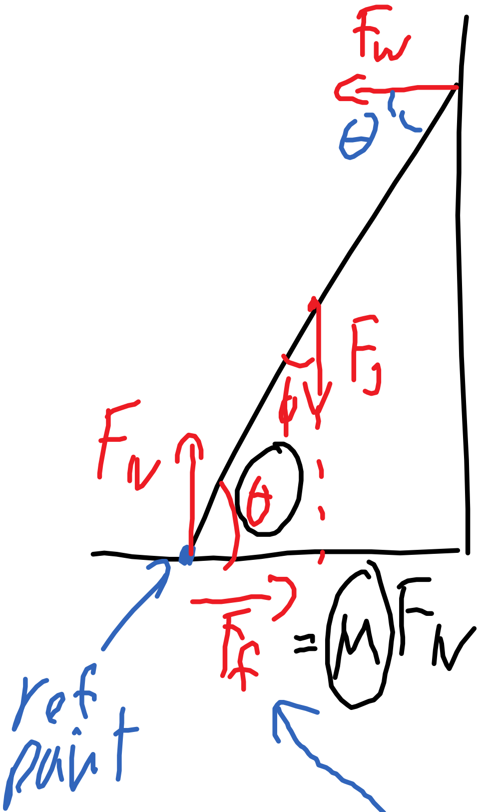
a) 176.4/(2xSin(17.74467162505693))=
289.3931247023675

Atan(2/6.25)=17.74467162505693

b)
176.4/(2xSin(Atan(0.2/6.25)))=
2,757.66083891765

Q19 use trig identities sin(90-θ)=cosθ
sinθ/cosθ=tanθ

Frictionless



$\phi = 90 - \theta$

$\tau_c = \tau_{cc}$

$F_g \frac{\Delta}{2} \sin\phi = F_w \Delta \sin\theta$

$F_N = F_g$

$F_w = \frac{F_g \sin\phi}{\ldots}$

$$F_f = F_w = \mu \cancel{F_g} = \frac{\cancel{F_g} \sin\phi}{2\sin\theta} \quad 2\sin\theta$$

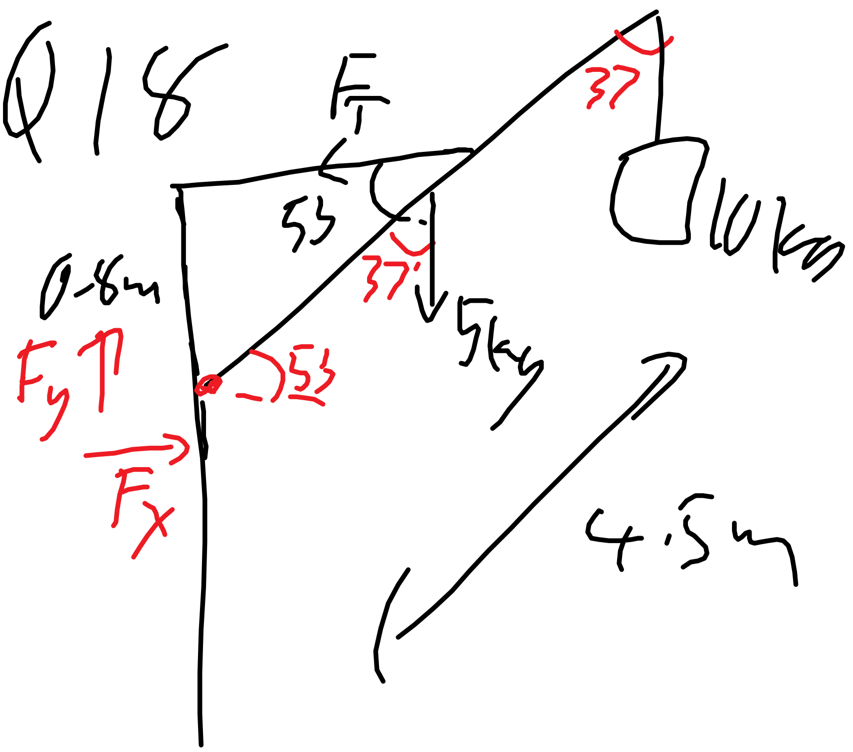
$$\phi = 90 - \theta \qquad \sin\phi = \cos\theta$$

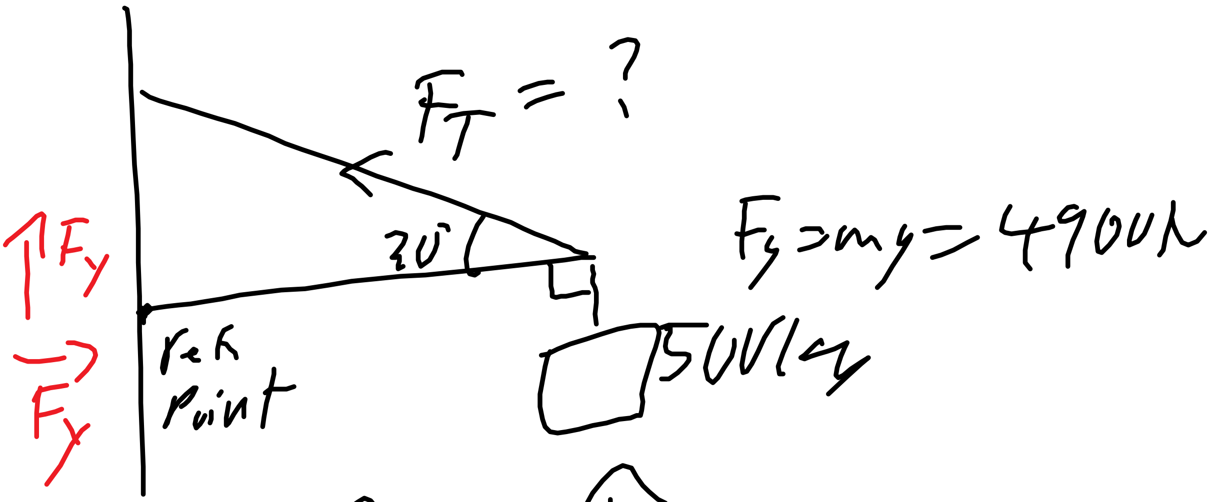
$$\mu = \frac{\cos\theta}{2\sin\theta} = \frac{1}{2\tan\theta}$$

$$\tan\theta = \frac{1}{2\mu}$$

$$\boxed{\theta = \tan^{-1}\left(\frac{1}{2\mu}\right)}$$

Q18





$$\tau_{c} = \tau_{cc}$$

$$4900N\,\cancel{\ell} = F_T\,\cancel{\ell}\,\sin 30$$

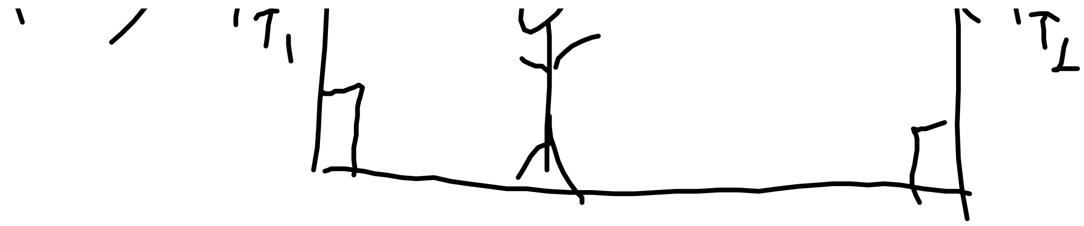
$$\boxed{F_T = 9800N}$$

b) $F_y = F_g - F_T \sin\theta = 0$

$F_x = F_T \cos\theta = 9800N \cos 30°$

$= \boxed{8.5 \times 10^3 N}$

Q3



$\uparrow F_{elastic} = kx$

$\rightarrow$ Energy $= \frac{1}{2}kx^2$

a) $mg(h+x) = \frac{1}{2}kx^2$

b) $F_{net} = ma = \underset{up}{F_{elastic}} - \underset{down}{F_g}$

$\underline{ma = kx - mg}$

Q1

$$p_2^2 = p_1^2 + (mv)^2 - 2p_1(mv)\cos\theta$$

or

x $\quad mv = p_{1x} + m_\alpha v_\alpha \cos\theta$

y $\quad 0 = p_{1y} + m_\alpha v_\alpha \sin\theta$